



STAR FIELDS

Newsletter of the
Amateur Telescope Makers of Boston
Including the Bond Astronomical Club
Established in 1934
In the Interest of Telescope Making & Using

Vol. 24, No. 1 January 2012

This Month's Meeting...

Thursday, January 12th, 2011 at 8:00 PM
Phillips Auditorium
Harvard-Smithsonian Center for Astrophysics
Parking at the CfA is allowed for the duration of
the meeting.

Searching for the Universe from Iron Mine

Dr. Steve Leman

"We understand the nature of only 4% of the Universe - stars, gas, rocks, you, and me - so called baryonic matter. Precision astrophysical measurements and detailed modeling allow us to understand that 23% of the Universe is comprised of material that helped form the earliest galaxies and today affects the orbital dynamics of galaxies and galaxy clusters - dark matter. It is invisible yet interacts gravitationally. On large scales, its gravitational effects dominate that of the ordinary matter. The remaining 73%, termed dark energy, is pushing galaxies apart at an accelerating rate and will lead to a cold death of the Universe.

Our galaxy, the Milky Way, is believed to exist within a much larger dark matter structure, and we move through it relatively unimpeded. This allows us to set up detectors here on earth and search for dark matter signals. Our group works on one such experiment, the Cryogenic Dark Matter Search, located in an inactive iron mine in Soudan, Minnesota.

The main theme of this talk will focus on motivation for the dark matter hypothesis, our dark matter search experiment's design, detectors, and search results. People of all backgrounds are invited and no background knowledge in astro-particle physics is needed."

Steve Leman presently works on the Cryogenic Dark Matter Search (CDMS) and Micro-X Microcalorimeter X-ray Telescope experiments at the Experimental Cosmology and Astrophysics

Laboratory at MIT. He founded and continues a leadership role in the CDMS detector Monte Carlo group through its studies of the experiment's novel gamma/neutron detectors. This work involves detailed modeling of phonon and charge transport physics in cryogenic germanium detectors in support of detector characterization, design, signal processing, and data analysis. In Micro-X, he designed and tested multiple subsystems and participates in integration of the instrument. Previous work has included novel silicon and germanium X-ray imaging spectrometers for astrophysical observations along with gamma-ray detectors for positron annihilation spectroscopy. His work combines theoretical and computational ability with hands-on laboratory work.

President's Message

As I'm writing this note, Winter Solstice is about to happen. Near my house, at Half Moon Meadow Brook in Boxborough, there are stone structures that are thought to have been placed there by Native Americans. Early on a cold Winter Solstice morning, a small group of us walks across a field through several inches of fresh snow. The morning is clear and dark, and we are there to witness the sunrise. We take turns standing on a stone platform and look Southeast to a large stone monolith across the field which has a notch in the top. The Sun just breaks the horizon, and after a few minutes, while standing on the platform rock, we are able to view the Sun framed directly in the notch of the monolith. It's a beautiful way to start the winter!

It is inspiring to know that long ago, Native Americans studied the Sun and the seasons, and were able to understand the its annual cycle movements. It is believed that they are the ones who constructed this miniature observatory, which, although much smaller than other ancient alignment observatories, at the same time is more intimate. The movements of the Sun and Moon were very important to many ancient civilizations, and there was a strong motivation to track their movements- maybe this gave ancient people comfort that the annual cycle had been and would continue to be repeated, or maybe it was a way to feel a connection between their lives and the cosmic cycle.

At the present day, in an age when computers can predict solar motion with exquisite accuracy, people are still fascinated with observing alignments of the Sun with human structures. In early November, an article in the newspaper described how the Sun shines through a window at the end of MIT's famed Infinite Corridor. For a brief moment, on two days a year, its rays penetrate its entire 825-foot length of the corridor. This year the event was predicted to happen on 11/11/11, which added to the interest. About 100 spectators grouped to see the alignment, which was described by one spectator as "it was just so gorgeous". It's interesting to know that even now during our era, the predictions are just a little bit off of the actual moment that the beam of sunlight makes it to the end of the corridor.

So, the human tradition of interest in cosmic alignments continues with sophisticated MIT students. In a more general way, we members of ATMoB are also fascinated with the cosmic events, and each in our own way keeps track of the cosmos and tries to understand its complexity and beauty. In a very real sense, we are probably motivated very much like those ancient

observers, and so we may feel a connection to them across millennia when Man first noticed and tried to understand his place in the universe.

Keep looking up,

~ *Bernie Kosicki, President* ~

December Meeting Minutes

Minutes of ATMOB meeting held Decemeber 8, 2011

Meeting held in Phillips Auditorium, Harvard-Smithsonian Center for Astrophysics.

Bernie Kosicki, President: called the meeting to order at 8:00 PM.

Dr. Sheperd Doelman, Ph.D. of the MIT Haystack Observatory gave a talk entitled "The Event Horizon Telescope: Observing Black Holes with Schwarzschild-Radius Resolution." Shep gave a description on the Very Long Baseline Interferometer (VLBI) radio telescope, which he is helping to construct to image the event horizon of black holes. The event horizons of the black holes at the center of the Milky Way and at the center of M87 subtend a small angle from Earth, only a tiny fraction of an arc second.

However, with a telescope with an effective aperture of the diameter of Earth, Shep expects to image the event horizons of black holes in the Milky Way and in nearby large galaxies.

The telescope is being constructed of radio antennas in California, Arizona, West Virginia, Hawaii, Chile, Africa, Europe, and perhaps also China and Japan. The antennas work together as a large interferometer. The data from the antennas is recorded along with a clock signal. A clock which is expected to lose only about one second every 100,000 years is under construction for the VLBI. A computer reconstructs the received wavefront from all antennas as one image using the clock reference. The resulting image from this huge telescope is expected to have sufficient angular resolution to generate an image of the event horizon of the black hole. Currently large single antenna radio telescopes and smaller interferometer arrays have only produced images of black holes and jets which are emitted by accretion disks of the black holes.

The event horizon can be imaged because the charged particles (electrons, protons and heavier atoms which are ionized that are the material of the accretion disk) radiate electromagnetic radiation as they are accelerated by swirling outside of the black hole. Some of this electromagnetic radiation is in the radio frequency range to be detected by the VLBI.

Shep mentioned several motivating questions for the VLBI study which included:

- Is there an Event Horizon of the Black Hole (BH)?
- Does General Relativity (GR) hold near BH?
- How does matter accrete/outflow near a BH?
- Do Black Holes have spin?
- How do Black Holes launch jets?

One model is that both a black hole and the associated accretion disk rotate. The axis of rotation may be the same or different, and the directions of rotation of the two may be the same or different. Both rotations produce magnetic fields, and if the rotations are in different directions, the magnetic field lines become entangled and the sum of the magnetic fields varies with time, thereby producing the jets by ordinary time dependent magnetic induction acting on the electrically charged particles of the accretion disk. Ordinary magnetic induction is the effect that is used by electric power companies in a rotating electric generator, discovered by Michael Faraday in about the year 1831.

The entanglement of the magnetic field from a counter-rotating black hole and accretion disk is believed to produce a torque between the black hole and the accretion disk. The torque is believed to cause these rotations to slowly become the same. The entanglement of the magnetic fields will slowly reduce, and finally the jet will fail to be produced. So, older galaxies may have their black hole and accretion disk rotating in the same direction, and the jet production is lost.

The black hole at the center of the Milky Way is named Sagittarius A* (Sgr A*). This black hole has been studied in several regions of the electromagnetic spectrum, including the x-ray, optical visible region, infra red, and radio with less space resolution than will be provided by the VLBI. The Schwarzschild Radius, or more colloquially, the radius of the black hole of Sgr A*, is thought to be about 10 micro arc seconds. A shadow of the black hole is expected to be about 5.2 Schwarzschild radii for a non-spinning black hole and about 4.5 Schwarzschild radii for a black hole with maximum spin. Observation by the VLBI should help determine whether a real black hole has a Schwarzschild radius and its size, if any.

The resolution of the VLBI will depend upon the wavelength of the radio waves used. Expected resolutions for different wavelength radio waves are given by dividing the wavelength by the effective diameter of the VLBI, and are for wavelengths of a centimeter (cm), 1.3 millimeter (mm), and 0.8 mm:

Resolution:

- wavelength/D (cm) ~ 0.5 mas (milli-arcseconds)
- wavelength/D (1.3 mm) ~ 30 μ s (micro-arcseconds)
- wavelength/D (0.8 mm) ~ 20 μ s

The VLBI is being designed to operate at a wavelength of about 1.0 millimeter, or less.

In addition to providing sufficient angular resolution, the short wavelength radio waves are needed to penetrate the ion cloud believed to surround the accretion disk. For example, to penetrate the ion cloud at the top of the Earth's atmosphere, known as the ionosphere, communication with satellites must use radio waves of shorter than about 10 meters, and usually shorter than 1 meter. The ion cloud around the accretion disk of a black hole is believed to be much denser than the Earth's ionosphere, and so radio waves in the millimeter range are believed to be necessary to penetrate the accretion disk ion cloud. Stars orbiting around Sgr A* have been photographed in the infrared frequency range

where the wavelength of the electromagnetic waves is about 1-10 microns (which is 1-10 thousandths of a millimeter). Observations at a wavelength of about 1.3 millimeters by an interferometer were taken recently and presented by Shep. The interferometer had antennas in California and Hawaii that indicated the size of Sgr A* of about 4 Schwarzschild radii.

Also, the observations indicated that the strength of the received signal varies in time, with the time variation being in the hour time scale. This time variation is believed to be due to bunches of charged particles circling around the event horizon as they leave the accretion disk and fall into the black hole. That is, the charged particles are apparently not uniformly distributed around the circle of the event horizon, but are bunched up, and the bunch radiates in a time dependent manner as observed from Earth.

If the above model of black hole interaction with its accretion disk is correct, then observations of the time dependent signal from old and new galaxies should show a difference in jet production.

Observations with the VLBI radio telescope will help determine actual behavior as the accretion disk and black hole interact. This test of General Relativity will be on line and producing observations in time for the 100th anniversary of Einstein's publication of General Relativity.

After the talk a short business meeting was held.

Bob Naeye mentioned that the next issue (January) of Sky and Telescope would have an article about Shep and black holes.

The Secretary's Report of the November meeting was given by Sidney Johnston.

Bernie Kosicki presented the treasurer's report prepared by Nanette Benoit.

Tom McDonagh gave the Membership Committee Report.

John Reid gave the Clubhouse Report.

No Observing Committee Report was given.

Glenn Chaple discussed setting up instruction for how to use a telescope and find desired stars and objects in the sky for members who are not familiar with using a telescope.

Mario Motta mentioned that there is one slot available for the eclipse trip to Australia.

No old business.

No new business.

The meeting was adjourned at 9:39 PM.

Refreshments were provided by Tom McDonagh.

~ *Sidney Johnston, Secretary* ~

Clubhouse Report

This year closes with 18 members donating 50 workdays during nine visits to the Clubhouse from November 20 through December 17. The regular thursday evening mirror grinding activity continued, the friday night astronomy class, and saturday night observing on the field continued. A summary of the work activity is next, the date followed by the number of participants in parentheses.

November 20 (8) As the reader will recall, at the end of the November report expectations included a November 20 work session to complete the observatory entrance platform-step. This was completed by Dave P. and Paul C. Construction debris and storm damage tree debris was collected for removal or later chipping.

November 26 (6) Working on the side porch, paint remover gel was applied to the old solid wood donated door to be used for the observatory. Several members encountered problems with metal doors rusting apart, which convinced us to stick with old solid wood doors. The Far-Barn door hasp was replaced/repared. Supplies were inventoried for replacement purchase.

November 27 (9) The second application of paint remover gel proved that this product was not meant for serious paint removal. It had taken several hours to prove this deficiency. Research started on a proven product.

November 28 (2) Door restoration moved to the house basement to allow tidying up for the MIT star party visit. The product still being researched.

December 4 (5) A new sprayable paint remover with 15 minute action from Lowe's was found to have a good product history and was tried. It proved to be a reliable product, capable of removing large quantities of soft old paint. Repeated applications are required with an intermediate sanding; followed with an application with remover and steel wool hand scrubbing. Work continued. Meanwhile the kitchen collection was reorganized and surplus materials removed.

December 10 (13) This work party was devoted to debris collection and removal. However MIT/Westford surprised us by removing the many piles of tree debris along the access road including near the clubhouse. So the intrepid crew of Steve C., Joshua A., and Glenn C. cleared the entire tree line of fallen limbs and large debris pieces; they are piled neatly at the driveway curve for chipping/removal. Meanwhile coarse sanding continued on both sides of the old door. One side followed thru to fine grit. Smaller implements were needed to clean the trim molding and recessed panels.

December 12 (2) A variety of sanding tools were tested and a shopping list compiled for door restoration completion.

December 17 (2) New sanding fixtures showed promise. Several more days of work should have the door ready for fitting, cutting and installation at the next work party scheduled on January 7th, 2012 Meanwhile periodic visits to the site by our foreman for this

construction, Paul C., have identified the dome areas needing further sealant. Dave and Paul are slowly eliminating paths for unwanted water to enter. Unique methods using dry spray powders to follow water trickle paths have been used. We are slowly approaching the day when we can alert Larry S. to invite the building inspector for the final inspection.

We need to thank publicly the following members who made these efforts possible; their number of days is in parentheses: Joshua Ashenberg (1), John Blomquist (6), Barbara Bosworth (1), Glenn Chaple (1), Paul Cicchetti (3), Steve Clougherty (2), Eric Johansson (2), Richard Koolish (1), John Maher (1), Mike Mattei (1), Eileen Myers (3), Dave Prowten (2), John Reed (10), Phil Rounseville (1), John Small (3), Art Swedlow (4), Al Takeda (4), and Sai Vallabha (4).

The next work party will take place on the full moon Saturday January 7th, 2012. Starting at 10am, we'll start with a hot cup of coffee; but dress warmly for the next few sessions for the weather will be cold. We'll do projects both in and outside, trying to keep our clubhouse in good shape to allow us to enjoy our observing there. The Spaghetti lunch will recharge our batteries at 2PM. So consider the challenge and join us! Clear skies TO ALL. Happy Holidays!

~ **Clubhouse Committee Chairs** ~
~ **John Reed, Steve Clougherty and Dave Prowten** ~

Clubhouse Saturday Schedule

January 7	Cicchetti & Reed
January 14	Jacobson & Johansson
January 21	Maerz & Meurer Work Party #1
January 28	Evans & Lumenello
February 4	Panaswich & Small
February 11	Berger & Hill
February 18	Leacu & Rounseville Work Party #2
February 25	Myers & Nugent

Thoreau on Astronomy

The snow turned to a fine mist or muzzling, through which I see a little blue in the snow, lurking in the ruts.

Journal, 3 January 1856

~ **Submitted by Tom Calderwood** ~

Membership Report

Membership count as of 12/18/2011 is at 262 individuals
Same time last year: 262

I have been working on a new member website and I am now seeking input on the content and format. My goal is to make is a comprehensive introduction to the club for new members and old alike. Please take a few moments to check out the beta website. Any and all feedback is greatly appreciated.
membership@atmob.org

http://web.me.com/tom_mcdonagh/ATMOB_NM/Welcome_from_the_Amateur_Telescope_Makers_of_Boston.html

The Amateur Telescope Makers of Boston, Inc. is a 501(c)3 organization. Donations are gladly accepted and are tax deductible to the fullest extent allowed by law. Consider making a tax-deductible contribution to the club when renewing your membership. Many companies make matching contributions at an employee's request. This is a simple way to make your donation go twice as far.

Please take the time to seek out and welcome our new and returning club members:

Rahul Bhutani	John Edmundson
Eli Cook	Lindon Steadman
Anthea Coster	Roseanne Tinkler

Best regards and Happy New Year!

~ **Tom McDonagh, Membership Secretary** ~

MIT Open House a Success!

The postponed Open House for our MIT on the hill took place on Wednesday, Nov 30. Among the enthusiastic attendees was the Director of Haystack, Colin Lonsdale, and Richard Crowley, our contact on network matters. About 25 MIT people attended, including a fair number of children. Several folks expressed interest in joining ATMoB, and one signed up on the spot. We've seen more and more that families with children want to join, so we need to discuss whether as a club we will offer a family membership.

We offered hot chili and other food for the visitors, gave tours of the observatories and facilities, and had observing in the field. In spite of clouds that moved in after about an hour (or maybe because of them) there was lots of discussion between members and visitors.

Thanks to all our members who showed hospitality and were generous in sharing expertise in astronomy with our guests: Jon Blomquist, Bruce Berger, Glenn Chaple, Tom Calderwood, Mike Hill, Eileen Myers, Phil Rounseville, Al Takeda, Sai Vallabha, and to my wife Pat for making two pots of chili and a few batches of brownies. We all agreed that the event was a big success.

~ **Bernie Kosicki** ~

MIT Open House a Success!

We will continue discussion of the report of the Strategic Planning Committee. This discussion will set broad priorities of the club for several years to come, and so if you are interested in these issues, please consider attending.

One issue will be membership categories in the club. More and more families are interested in joining, yet the club has no family membership. We'll also be discussing whether and not to add this category.

~ **Bernie Kosicki** ~

Astronomy Day 2012

Following the first quarter moon, Astronomy Day moves to Saturday, April 28 this year. The past two years have drawn over a thousand people, and we expect as many or more this year. Outdoor events run 4:00-9:30 pm and indoor events run 5:00-8:30 pm. Please join us for the festivities. If you have questions, call Bob Phinney – 617-454-2718.

<http://www.claycenter.org>

~ **Bob Phinney** ~



Photo by Dick Koolish

Starlab portable planetarium training session led by Virginia Renahan and George Roberts at CfA on November 28

Sky Object of the Month

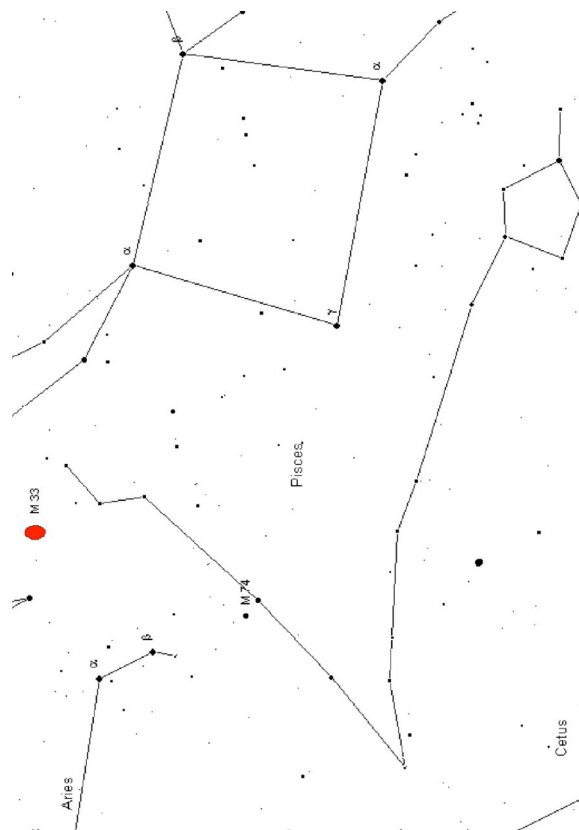
M74 – Galaxy in Pisces

Last month, we explored the galaxy M33, a notoriously difficult telescopic target due to its extremely low surface brightness. For the same reason, M74 is even more challenging; in fact, many consider it the most visually demanding of all the Messier objects. Upon discovering this galaxy in 1780, the French astronomer Pierre Mechain remarked, “It is quite broad, very dim, and extremely difficult to observe.” M33 is commonly described as a 6th magnitude star defocused until its light is spread over an area twice the apparent diameter of the moon. With M74, we have a magnitude 9.5 star whose light is extended over an area 10 arc-minutes across. No wonder M74 bears the nick-name the “Phantom Galaxy!”

The good news is that M74 can be captured if you know where to look and (most importantly!) observe from a clear, dark sky. In fact, I’ve glimpsed it (albeit faintly) with a 3-inch f/6 reflector. Viewed with averted vision, it appeared as a ghostly blob of light. The key was in conducting my search with a low power (30X) eyepiece.

M74 is situated 15 degrees south of its elusive cousin and 1 ½ degrees east and slightly north of the 4th magnitude star eta (v) Piscium (refer to the accompanying finder chart). In size, it’s

essentially an equal to our Milky Way. M74 lies about 32 million light years away, about 15 times more distant than M33.



Finder chart for M74
From Cartes du Ciel

2012 Club Meeting Dates

January 12	July 12*
February 9	No meeting in August
March 8	September 13
April 12	October 11
May 10	November 8
June 14	December 13

* Held if a meeting is proposed and favorably voted for by the membership in attendance at the June meeting.

All meetings held at the Phillips Auditorium at the Center for Astrophysics at 60 Garden Street, Cambridge MA. Parking is available on site for the duration of the meeting.

February Star Fields DEADLINE

Noon, Sunday, January 22

**Email articles to the newsletter editor at
newsletter@atmob.org**

Articles from members are always welcome.

POSTMASTER NOTE: First Class Postage

Amateur Telescope Makers of Boston, Inc.
c/o Tom McDonagh, Membership Secretary
48 Mohawk Drive
Acton, MA 01720
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OBSERVING AND PUBLIC OUTREACH

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Virginia Renehan starparty@atmob.org

How to Find Us...

Web Page: <http://www.atmob.org>

MEETINGS: Held the second Thursday of each month (September to July) at 8:00PM in the Phillips Auditorium, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge MA. For INCLEMENT WEATHER CANCELLATION listen to WBZ (1030 AM)

CLUBHOUSE: Latitude 42° 36.5' N Longitude 71° 29.8' W

The Tom Britton Clubhouse is open every Saturday from 7 p.m. to late evening. It is the white farmhouse on the grounds of MIT's Haystack Observatory in Westford, MA. Take Rt. 3 North from Rt. 128 or Rt. 495 to Exit 33 and proceed West on Rt. 40 for five miles. Turn right at the MIT Lincoln Lab, Haystack Observatory at the Groton town line. Proceed to the farmhouse on left side of the road. Clubhouse attendance varies with the weather. It is wise to call in advance: (978) 692-8708.
